Surface Tension

How can insect stand on water … ???

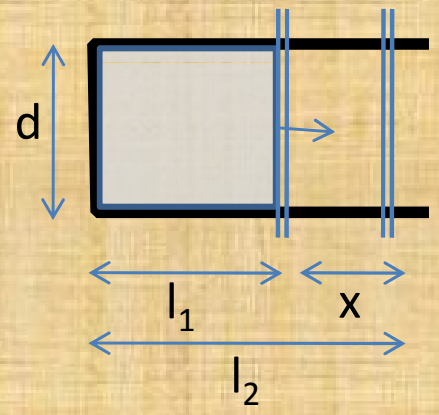

Figure 5
A film of liquid suspended
In wire frame

$W = n\, w'$

$n \approx \Delta A$

$n = a(A_2 - A_1)$

$= 2\, ab(l_2 - l_1)$

$= 2\, abx$

$W = 2\, abx = F\, x$

$$\frac{F}{b} = 2aw'$$

a = the number of molecules per unit area on the surface

aw' = surface tension

Aplikasi dalam Biologi :

How can tightrope walker do … ???

$2T \cos \theta$

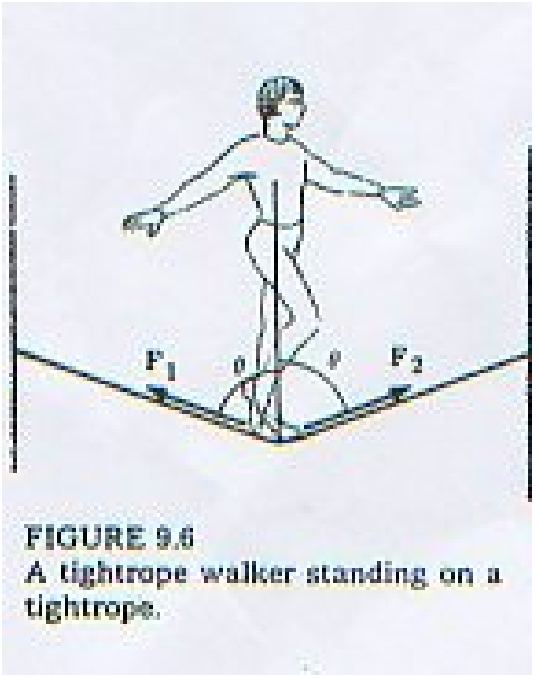

FIGURE 9.6
A tightrope walker standing on a tightrope.

So, how about insect … ???

$2\pi r\Upsilon \cos \theta$

FIGURE 9.7
An insect's leg supported by the surface tension of water.

What the mean boil ... ???

$F_t = 2\Upsilon 2\pi r = 4\Upsilon\pi r$

$F_i = A\,P_i = \pi r^2 P_i$

$F_o = A\,P_o = \pi r^2 P_o$

$F_t = F_i - F_o = (P_i - P_o)\,\pi r^2$

$4\Upsilon\pi r = (P_i - P_o)\,\pi r^2$

$$\frac{4\gamma}{r} = P_i - P_o$$

Or

$$\frac{2\gamma}{r} = P_i - P_o$$

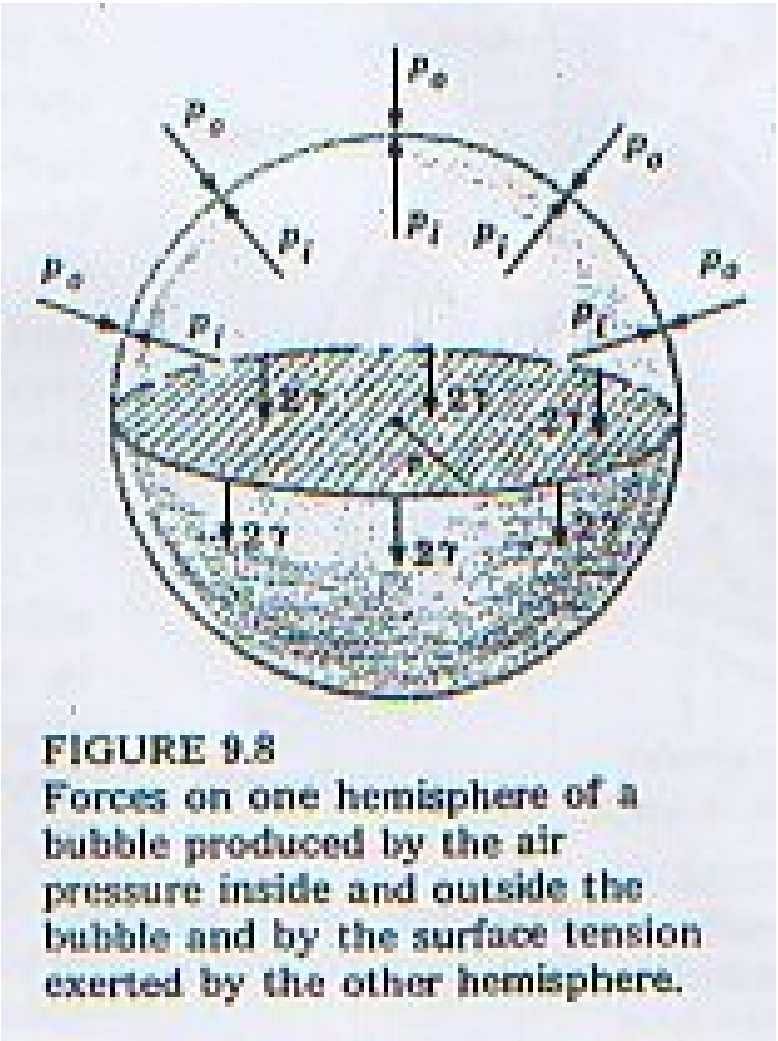

FIGURE 9.8
Forces on one hemisphere of a bubble produced by the air pressure inside and outside the bubble and by the surface tension exerted by the other hemisphere.

Surfactants

What the mean surfactant ... ???

Any substances that reduces the surface tension of a liquid

Saat bernapas jejari alveoli mengembang dari 0.5 x 10^{-4} menjadi 1.0 x 10^{-4} m, dan selaput membran memliki tegangan permukaan 0.050 N/m

$$\frac{2\gamma}{r} = P_i - P_o = \frac{2\ x\ 0.050\ N/m}{0.5\ x\ 10^{-4} m}$$

$$P_i - P_o = 2\ x\ 10^3\ Nm^{-2} = 15\ mm\ Hg$$

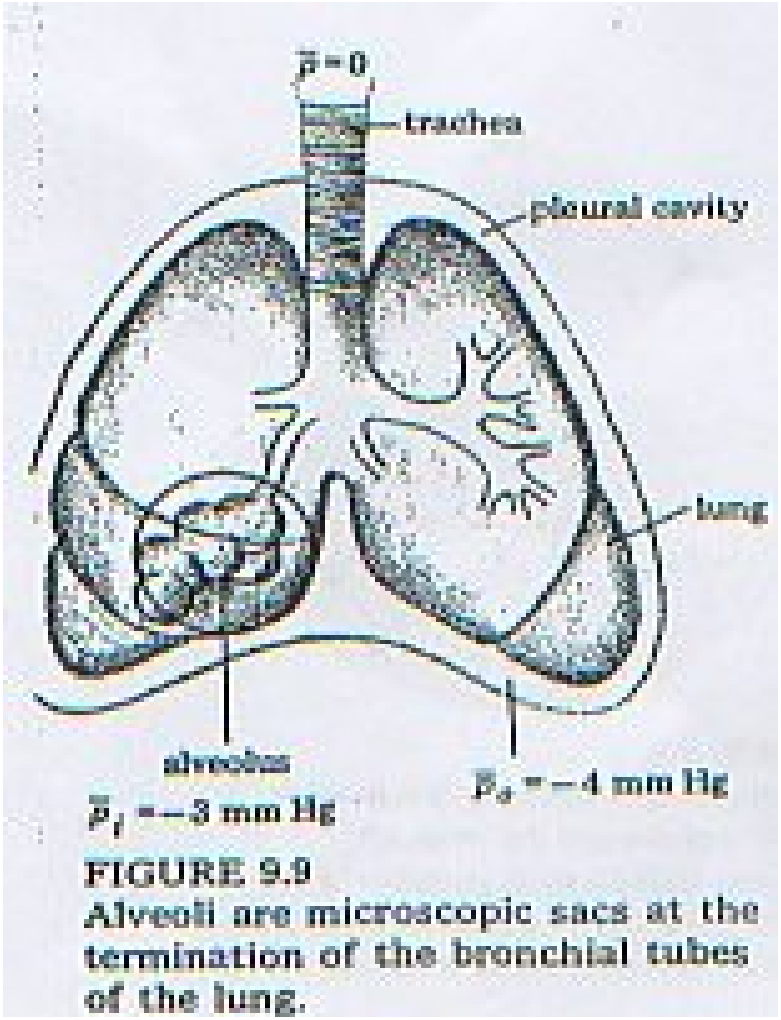

FIGURE 9.9
Alveoli are microscopic sacs at the termination of the bronchial tubes of the lung.

Pada keadaan napas biasa, tekanan pada alveolus mendekati 3 mm Hg dibawah tekanan atmosphere (sehingga tekanan terukurnya itu adalah -3 mm Hg)

Tekanan luar alveolus -18 mm Hg

Negative artinya menahan dinding ruang

Kenyataannya tekanan luar alveolus adalah -4 cm Hg

Surfactant do it……